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DOOR ASSEMBLY FOR AN IMAGE FORMING DEVICE

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DOOR ASSEMBLY FOR AN IMAGE FORMING DEVICE

Background

Image forming devices, such as printers, often include replaceable components, such as toner cartridges, PC members, etc. These components are used during the image formation process and are eventually worn-out or exhausted. Users should be able to remove and replace these components when necessary.

Placement and mounting of these components is vital to acceptable user ergonomics. The components should be positioned in a manner to be accessible to the user. The complex design of many current devices makes accessing the components difficult. The cartridges may be located within the interior of the device making it very difficult to grasp and manipulate the cartridges. Difficult cartridge mounting locations may also result in the user getting toner on their hands and fingers by inadvertently contacting the toner outlet on the cartridge. Additionally, some of the components may be damaged during mounting, such if contacted by the user's hands or fingers, or scrapped against the device. Damaged components may result in print defects, or the device not operating properly.

It is also important that the components be mounted within the device to produce images of acceptable print quality. This requires that the components are accurately located within the device during image formation. Inaccurate locating of the cartridges may result in image forming defects, toner leakage, and other detrimental effects.

Further, the device should be constructed in an economical manner. Price is one of the leading factors when a user makes a purchasing decision for an image forming device. Improvements to user ergonomics and component locations should add to functionability of the device, but not at a price that will drive away potential users.

Summary

The present invention is directed to mounting a unit on a door assembly of an image forming device. In one embodiment, a first mount and a second mount are positioned on the door assembly. A cartridge unit includes a first attachment and a second attachment that connect respectively to the first and second mounts. Once connected, the cartridge unit remains attached as the door assembly moves between open and closed orientations.

The attachment of the cartridge unit is straight-forward and intuitive to the user. The design also prevents the cartridge unit from being installed backwards. Further, the attachments and mounts are positioned to not interfere with the image forming process.

Brief Description of the Drawings

Figure 1 is a schematic view of an image forming device in a closed orientation according to one embodiment of the present invention;

Figure 2 is a cut-away perspective view of the door in an open orientation according to one embodiment of the present invention;

Figure 3 is a cut-away side view of the door assembly in an open orientation according to one embodiment of the present invention;

Figure 4 is a partial perspective view of the first attachment distanced from the first mount according to one embodiment of the present invention;

Figure 5 is a partial perspective view of the first attachment connected to the first mount according to one embodiment of the present invention;

Figure 6 is a partial perspective view of the second attachment distanced from the second mount according to one embodiment of the present invention;

Figure 7 is a partial perspective view of the second attachment connected to the second mount according to one embodiment of the present invention; and

Figure 8 is a schematic view of another embodiment of an image forming device in an open orientation.

Detailed Description

Figure 1 depicts a representative image forming device, such as a printer, indicated generally by the numeral 10. The image forming device 10 comprises a main body 12 and a door assembly 13. A media tray 14 with a pick mechanism 16, or a manual input 32, are conduits for introducing media sheets into the device 10. The media tray 14 is preferably removable for refilling, and located on a lower section of the device 10.

Media sheets are moved from the input and fed into a primary media path. One or more registration rollers disposed along the media path align the print media and precisely control its further movement along the media path. A media transport belt 20 forms a section of the media path for moving the media sheets past a plurality of image forming units 100. Color printers typically include four image forming units 100 for printing with cyan, magenta, yellow, and black toner to produce a four-color image on the media sheet.

An imaging device 22 forms an electrical charge on a photoconductive member 51 within the image forming units 100 as part of the image formation process. The media sheet with loose toner is then moved through a fuser 24 that adheres the toner to the media sheet. Exit rollers 26 rotate in a forward or a reverse direction to move the media sheet to an output tray 28 or a duplex path 30 respectively. The duplex path 30 directs the inverted media sheet back through the image formation process for forming an image on a second side of the media sheet.

The image forming units 100 are constructed of a first unit 40 and a second unit 50. The first unit 40, including a developer member 45, is positioned within the main body 12. The second unit 50, including a photoconductive member 51, is mounted to the door assembly 13. In a closed orientation as illustrated in Figure 1, the door assembly 13 is positioned adjacent to the main

body 12 with the photoconductive member 51 of the second unit 50 against the developer member 45 of the first unit 40.

Figure 2 illustrates a cross-sectional view of the image forming unit 100 in the closed orientation. The first unit 40 comprises an exterior housing 43 that forms a reservoir 41 for holding a supply of toner. One or more agitating members 42 are positioned within the reservoir 41 for agitating and moving the toner towards a toner adder member 44 and the developer member 45. Toner moves from the reservoir 41 via the one or more agitating members 42, to the toner adder roll 44, and finally is distributed to the developer member 45. The first unit 40 may be structured with the developer member 45 on an exterior section where it is accessible for being in contact with the photoconductive member 51.

The second unit 50 is illustrated in Figure 2 and comprises the photoconductive member 51, and a charger 52. In one embodiment, photoconductive member 51 is an aluminum hollow-core drum coated with one or more layers of light-sensitive organic photoconductive materials. Charger 52 applies an electrical charge to the photoconductive member 51 prior to the member receiving an electrostatic latent image from the imaging device 22. A cleaner blade 53 contacts the surface of the photoconductive member 51 to remove any toner that remains on the photoconductive member 51. The residual toner is moved to a waste toner auger 54 and moved out of the second unit 50. A housing 56 forms the exterior of a portion of the second unit 50. The photoconductive member 51 may be mounted on an exterior of the second unit 50 so it may be placed in contact with the developer member 45.

Figure 3 illustrates the image forming device 10 in the open orientation with the door assembly 13 moved away from the main body 12. The second units 50 are mounted on the door assembly 13 and distanced from the first units 40 within the main body 12. In this embodiment, door assembly 13 pivots about a pivotable connection 14 positioned towards a lower edge 15 of the door assembly 13. The position of the connection 14 causes an upper edge 16 to move away from the main body 12. In another embodiment, door assembly 13

remains in a vertical orientation as illustrated in Figure 8 as it moves between the open and closed configurations. The open configuration provides direct and easy user access to the first unit 40, second unit 50, and the media path. It has been determined that the highest user intervention rates are at the first unit 40, second unit 50, and media path.

The door assembly 13 includes attachments for connecting the second units 50. The attachments should make installation and removal easy and intuitive to the user, should not interfere with the image forming process, should maintain attachment of the second units 50 as the door assembly 13 moves between the open and closed orientations, and should not allow the second units 50 to be installed backwards. The door assembly 13 comprises a first mount 110 and a second mount 120 to receive the second units 50.

Figures 4 and 5 illustrate one embodiment of the first mount 110 having a T-shaped configuration with a post 111 and a cap 112. The post 111 extends outward at an angle substantially perpendicular to the door assembly 13. The cap 112 is positioned at a distal end of the post 111. The cap 112 has a width greater than a width of the post forming the T-shaped configuration. The larger width maintains the cartridge attached to the first mount 110 as will be explained in detail below.

Figures 6 and 7 illustrate one embodiment of the second mount 120 having a first finger 121 and a second finger 122. One or both of the fingers 121, 122 have a curved configuration with a channel 123 formed between the distal ends. In one embodiment, the curved configuration forms the channel 123 at a distal end, and an enlarged opening 129 between the distal ends and the door assembly 13. The channel 123 has a width that is smaller than a width of the opening. In one embodiment, the fingers 121, 122 have the same shape.

In a multi-color image forming device, a plurality of first mounts 110 and second mounts 120 are positioned on the door assembly 13 to receive the plurality of image forming units 100. The first mounts 110 are positioned adjacent to a first side 150 of the door assembly 13, and the second mounts 120 are positioned adjacent to a second side 151 that is opposite the first side. The

mounts 110, 120 are positioned outside of a working area 160 to not interfere with the image formation process. In one embodiment, the working area comprises the transport belt 20 and the mounts 110, 120 are positioned adjacent to each side.

The second unit 50 includes a first attachment 130 and a second attachment 140. In one embodiment, first attachment 130 is positioned at a first end of the second unit 50 and the second attachment is positioned at a second opposite end of the second unit 50.

First attachment 130 is sized to connect with the first mount 110. In one embodiment, the first attachment 130 includes a U-shaped slot 131 formed by members 132 that are spaced a distance apart forming an opening 133 therebetween. The slot 131 has a width that is greater than the width of the post 111 of the first mount 110, but smaller than the width of the cap 112.

The second attachment 140 is sized to connect with the second mount 120. In one embodiment, the second attachment 140 includes a neck 142 and a head 143. The neck 142 has a narrow width that is smaller than the width of the channel 123 of the second mount 120. The head 143 is positioned on an exterior side of the neck 142 and has a width greater than the channel width. The width of the head 143 may also be greater than a width of the opening 129 formed between the fingers 121, 122 of the second mount 120. The second attachment 140 is connected to the second mount 120 with the neck 142 within the channel 123. The head 143 prevents the neck 142 from laterally sliding out of the second attachment 140. A positioner 144 may also be located on the inside of the neck 132. The positioner has a width greater than the width of the channel 123 and opening 129 to prevent the second unit 50 from sliding laterally.

In one embodiment, a centerline of the U-slot 131 is aligned with an axis of the photoconductive member 51. A centerline of the neck 142 and head 143 is also aligned with the axis of the photoconductive member 51. In one embodiment, the centerline of the neck 142 and head 143 and the photoconductive member 51 are the same.

During the installation process, the user is unable to mount the cartridge in

the wrong orientation (i.e., upside-down) because the first attachment 130 connects with the first mount 110, and the second attachment 140 connects with the second mount 120. Attempts to improperly connect the cartridge are not successful. The user begins the process by initially mounting the slot 131 about the post 111. The slot 131 is prevented from lifting off the post 111 because the width of the cap 112 is larger than the width of the slot 131. Once the first attachment 130 is mounted, the unit is pivoted about the first attachment 130 such that the second attachment 140 connects to the second mount 120. Specifically, the neck 142 pushes through the channel 123 and is held between the fingers 121, 122. One or both fingers 121, 122 may be constructed of a flexible material such that the channel 123 expands during the insertion and than returns to the original size once the neck 142 has moved into the opening 129 formed below the distal ends of the fingers 121, 122.

Once the unit is mounted within the mounts 110, 120, the PC member 51 is positioned over the work area 160. In one embodiment, the PC member 51 is positioned adjacent to the transport belt 20 such that media sheets moving along belt 20 receive toner images from the PC member 51.

The unit 50 is roughly mounted to the door assembly 13 with enough play to provide for exact locating via the contact with the main body 12. Movement between the unit 50 and door assembly 13 may be caused by the width of the slot 131 being larger than the width of the post 111. In one embodiment, there is about 1mm clearance when the first attachment 130 is connected to the first mount 110. Likewise, the width between the fingers 121, 122 is greater than a width of the neck 142. In one embodiment, there is about 1mm of clearance. The cartridge is slightly movable on the door assembly 13, and becomes accurately located and fixed once the door is closed. The looseness of the connections is still adequate to maintain the unit 50 attached to the door assembly 13, even when moving the door assembly 13 between the open and closed orientations.

In one embodiment, the unit 50 is specifically located relative to the main body 12 when the door assembly 13 is in the closed orientation. One or more

reference datums positioned on the main body 12 accurately locate the unit 50, and the photoconductive member 51 relative to the developer member 45. One embodiment of a two-piece unit and locating the units relative to the main body and imaging device is disclosed in U.S. Patent Application Serial No. _/_____ entitled "Image Forming Apparatus Having a Door Assembly and Method of Use", concurrently filed with the present application, assigned to Lexmark International, Inc., and herein incorporated by reference in its entirety.

Figure 8 is a schematic illustration of another embodiment of an image forming device 10. One or more image forming units 100 are mounted on the door assembly 13. Each of the image forming units 100 includes both the developing and image forming elements and is constructed as a single unit. The door assembly 13 is movable relative to the main body 12 and imaging device 22 between an open orientation as illustrated in Figure 8 and a closed orientation mounted against the main body 12. In the open orientation, the image forming units 100 are accessible to the user, and mounted to the door assembly 13 in a similar manner as described above.

The term "image forming device" and the like is used generally herein as a device that produces images on a media sheet. Examples include but are not limited to a laser printer, ink-jet printer, fax machine, copier, and a multi-functional printer, scanner, and facsimile machine. One example of an image forming device is Model No. C750 produced by Lexmark International Inc.

The term "imaging device" refers to a device that places an electrical charge on the photoconductive element 51. Various imaging devices may be used such as a laser printhead and a LED printhead.

A transport belt 20 is illustrated in the embodiments for moving the media sheets past the image forming units 100, and as part of the door assembly 13. In another embodiment, roller pairs 191 are mounted to the door assembly 13 and spaced along the media path. The roller pairs 191 rotate to move the media sheets past the image forming units 100. In one embodiment, each of the roller pairs is mounted on the door assembly 13. In another embodiment, one of the

rollers is mounted on the door, and the corresponding roller of the pair is mounted on the main body 12.

The present invention may be carried out in other specific ways than those herein set forth without departing from the scope and essential characteristics of the invention. In one embodiment, both the photoconductive member 51 and the developer member 45 are cylindrically shaped. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.